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Taxonomic and Biological Notes on *Bellura gortynoides* Walker (Noctuidae)[1]

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Abstract. A taxonomic review is given for *Bellura gortynoides* Walker and related species. The biology of *B. gortynoides* is reviewed with new observations. The mature larva and pupa are described and illustrated.

Introduction

Bellura gortynoides Walker is one of the few Lepidoptera species that pass through their immature stages in an aquatic or semiaquatic environment. The taxonomic history of *B. gortynoides* and its related taxa is complex and confusing. The thirteen species described in this group of noctuids have been variously referred to as *Edema, Sphida, Arzama,* and *Bellura*. The taxa were primarily separated by the male frons, the color of the adult female anal tufts, and the presence of tubercles on the larval vertex (Hampson, 1910; Forbes, 1954). The usefulness and validity of these characters has since been refuted (Barnes and Benjamin, 1923; Forbes, 1954; Levine and Chandler, 1976). According to Levine and Chandler (1976), there are only three valid species, *gortynoides* Walker, *obliqua* (Walker), and *densa* (Walker), in a single genus, *Bellura*. However, the taxonomic problems are still not totally resolved.

Numerous articles deal with the biology of *B. gortynoides* (Center, 1976), but due to past taxonomic confusion, there is considerable doubt as to which apply to this species. Most are old and without precise observations, and in no case has the external morphology of the larva and pupa been studied in detail. Considering the taxonomic state of the group, more thorough studies could prove to be of value in clarification. This paper presents in detail the external morphology of the mature larva and pupa of *B. gortynoides*.

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Materials and Methods

Sixty-two larvae and 34 pupae were examined. These were collected from the following localities in Florida: Alachua Co.: Perry Pond, Biven's Arm, Sante Fe River north of High Springs, pond 1.4 miles east of River Styx off Highway 346; and Putnam Co.: Rodman's Reservoir, pond in Interlachen.

A WILD M-5 microscope and drawing tube attachment was used in making the illustrations. Measurements are based on the average of the available specimens.

Description of Stages

MATURE LARVA: Length: 52 mm, width: 4.8 mm. Head light yellowish brown with irregular, compounded blotches of darker brown varying in shade (Fig. 1); texture noticeably wrinkled, minutely granular; ocelli pigmented dark brown (Fig. 1, 10); mandibles heavily sclerotized with seven teeth, four strong and three weak (Fig. 3); labrum with ventral edge heavily sclerotized, irregularly shaped (Fig. 2); antennae three-segmented, third segment about size of sensilla basiconica, more distal sensillum trichodea four times size of other (Fig. 4); postmentum with ventral pair of short, stout setae (often asymmetrical) and basal sclerotizations; hypopharynx with two pairs of small ventral setae (often asymmetrical), some sclerotization, and dorso-lateral papillae; prementum with partially sclerotized ring, two-segmented labial palp with single preapical sensillum, second segment minute, sensillum-like; spinneret narrow, tapering (Figs. 7, 8); maxillary lobe with four prominent setae, basal largest, terminal lobe with large swelling bearing one pair of papillae and three setae, tip of lobe without tubercles (Figs. 5, 6); height of head: 3.0 mm, width: 3.2 mm. Dorsal view: body pale gray with green hue, somewhat transparent; mid-dorsal stripe gray, weak, darker than background; setae short, brown; extra subanal seta present (Fig. 13); prothoracic shield sclerotized, variable in shape, same color as head, with dark edges, anterior darkest with lateral extensions (Fig. 13); posterior margins of segments appear darker due to folding of integument; integument minutely coarse, much more wrinkled than head; spiracles on eighth abdominal segment larger and dorsad of preceding spiracles, directed caudally due to reduced size of ninth segment (Fig. 13); D2 seta of anal plate 1.3 mm in length (Fig. 12). Lateral view: body above spiracles colored as dorsum, white below; subspiracular stripe colored as mid-dorsal; irregularly arranged patches of light brown spots on dorsal and lateral surfaces of integument approximate setal bases in size, shown on second abdominal segment in Fig. 13; setal patterns on abdominal segments 3-6 nearly identical. third illustrated (Fig. 13); spiracles dark brown, light brown centered, eighth abdominal spiracle largest, followed by prothoracic spiracle, then seventh abdominal spiracle, spiracles 1-6 of equal size (Fig. 13). Ventral view: body white; thoracic legs

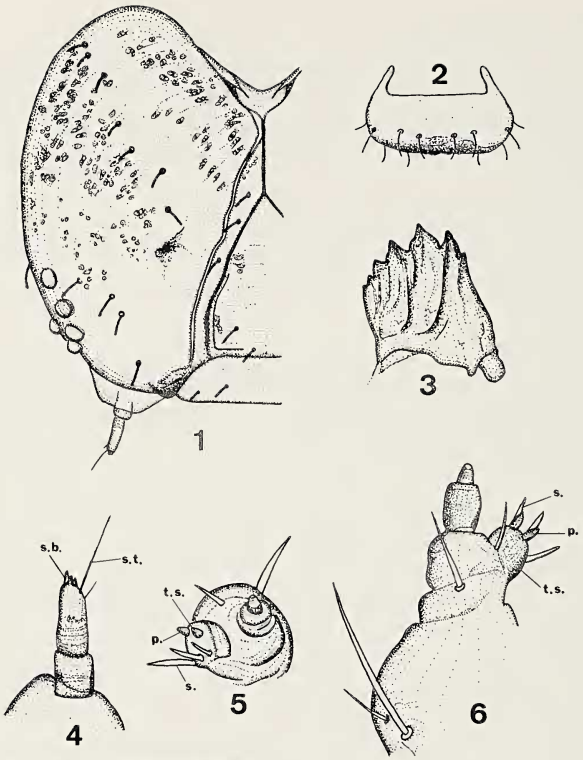

Fig. 1. Frontal aspect of head, 25X
Fig. 2. Frontal aspect of labrum, 25X
Fig. 3. Inner aspect of right mandible, 25X
Fig. 4. Ventral view of antenna, 75X; s.b., sensillum basiconica; s.t., sensillum trichodea
Fig. 5. Apical view of maxillary lobe, 75X, s., seta; p., papilla; t.s., terminal lobe swelling
Fig. 6. Ventral view of maxillary lobe, 75X; s., seta; p., papilla; t.s., terminal lobe swelling

light brown with brown claws (Fig. 9); anal prolegs reduced, posteriorly directed (Fig. 13); crochets uniordinal, numbers varying from 17-22 on segments 3-6, 11-14 on segment 10 (Fig.11).

PUPA: Length: 26.5 mm, width: 4.4 mm. Surface glossy; top of head and cremaster black, remainder deep reddish brown; cuticle finely wrinkled, minutely granular, granulation pronounced on posterior halves of abdominal segments 4-7, dorsum with sparse pitting causing integument to appear darkly spotted, top of head and cremaster rough with small, irregular, raised areas; male with encircling, serrated ridges on abdominal segments 5-7, teeth-like processes extending around to dorso-lateral

surface; segment 8 with small ridge ventrad, processes posteriorly directed on all segments, processes largest on segment 7 (Figs. 14, 16); female as described for male but ridge on segment 7 not on dorsum and ridge on segment 8 absent; cremaster with 4 hooks, each about 0.5 mm in length (Fig. 15); mesothoracic spiracle three times size of remaining spiracles; eighth abdominal spiracle dorsally located, slightly larger than other abdominal spiracles.

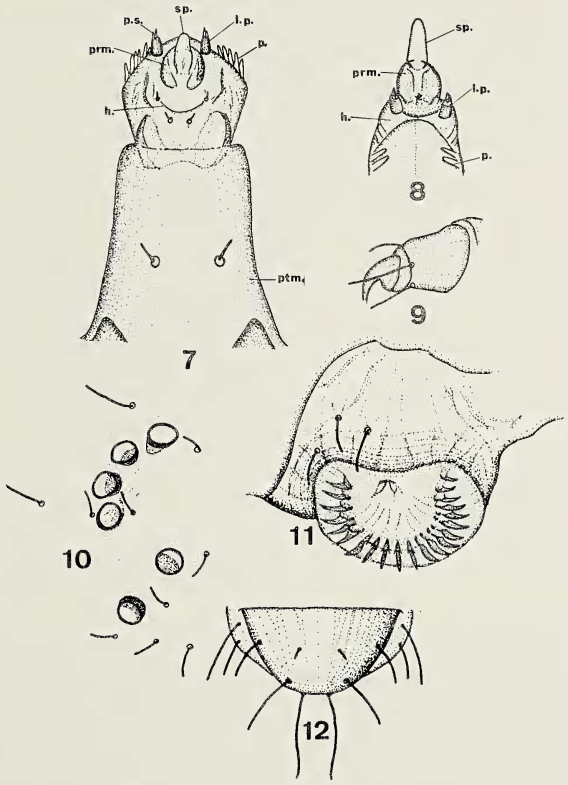

Fig. 7. Ventral view of mentum, hypopharynx, labial palpi, and spinneret, 75X; hypop., hypopharynx; l.p., labial palp; p., papilla; prm., prementum; ptm., postmentum; p.s., preapical sensillum; sp., spinneret

Fig. 8. Dorsal view of hypopharynx, prementum, labial palpi, and spinneret, 75X; hypop., hypopharynx; l.p., labial palp; p., papilla; prm., prementum; sp., spinneret

Fig. 9. Thoracic claw, 50X

Fig. 10. Ocellar arrangement and setal pattern, 50X

Fig. 11. Crochets, 50X

Fig. 12. Anal plate, 20X

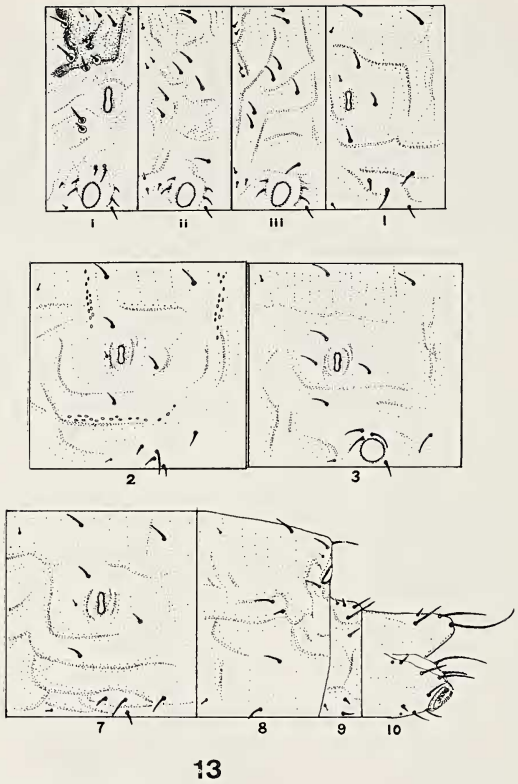

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Fig. 13. Setal maps, 15X

Field Observations

All specimens were collected from *Nuphar luteum* Engelm. or *N. advena* Ait. (Nymphaceae). It appears *N. luteum* has not previously been recorded as a foodplant.

The number of infested petioles consistently increase with water depth in all the localities. Since most plants had only one or two infested petioles, there is probably either wide dispersal of young larvae or a high mortality rate, as each egg mass contains 14-20 eggs.

The pupae were found tightly lodged in their tunnels. This is made possible by the toothed ridges which prevent the pupa from falling down the tunnel. The teeth-like processes are directed posteriorly to allow movement up with the rising water. The tooth ridges may also function to anchor the pupa during adult emergence.

The larva's palatability to fish was investigated by Mr. George Hutchinson, graduate student of the University of Florida, Entomology Depart-

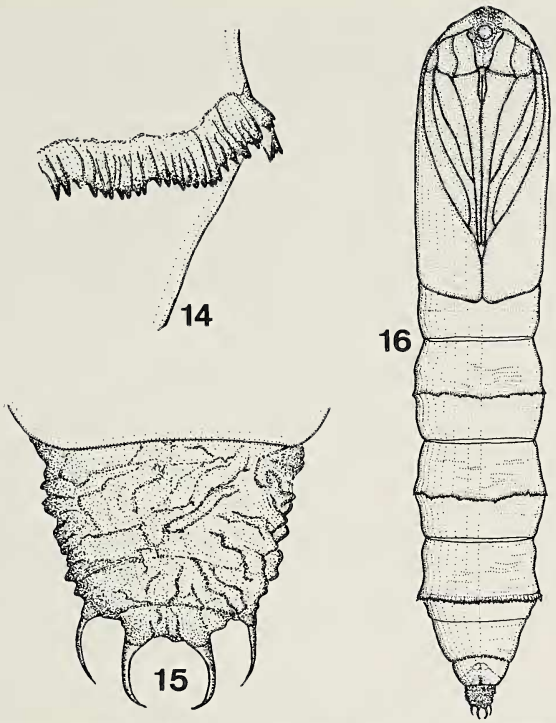

Fig. 14. Enlarged view of seventh abdominal ridge of pupa showing formation of teeth, 50X

Fig. 15. Ventral view of cremaster, 50X

Fig. 16. Ventral view of pupa, 12X

ment, during the fall of 1977. His observations suggest that they are eaten by fish, but only after the fish thoroughly washes the larva.

Other observations included finding adults resting beneath lily pads on surfaces free of water, and leeches occasionally occupying empty tunnels.

Discussion

The ova of *B. gortynoides* are characteristically laid in a mass of one to three layers and covered by the hair from the female's anal tuft. In Indiana, the first generation egg mass averages 14 and the second 20 (Levine and Chandler, 1976). The egg is pale yellow, hemispherical, slightly flattened at one end, with the chorion very finely pitted, 0.50 mm in height and 0.75 in width. The newly emerged larvae feed gregariously as miners on the parenchyma of the leaf. By the end of the second instar, the larva becomes solitary. Before the fourth instar, the larva stops mining and bores either into the midrib or petiole of the leaf, or swims to another leaf, as there is never more than one larva to a tunnel. Their oily epidermis helps to keep

them at the water's surface when they are swimming. The larva uses its specially adapted eighth abdominal spiracles when it needs oxygen by merely backing up the tunnel. Feeding is done nocturnally on the upper epidermis and leaf margins. As much as two-thirds of a leaf may be consumed. The number of larval instars varies from six to nine. Pupation occurs near water level and adults emerge in about two weeks. The only authenticated foodplants for *B. gortynoides* are *Nuphar* spp., though, because of its confusing synonymy, species of *Nymphaea, Eichornia, Pontederia* and *Typha* have been reported as hosts. Parasites and predators of *B. gortynoides* have been listed by Levine and Chandler (1976).

Nuphar advena Ait. can be a pest weed that interferes with navigation and causes silting. Levine and Chandler (1976) studied the potential of *B. gortynoides* as a biological control agent for this lily and concluded that it was an unlikely means of control, since the larva does not kill or greatly weaken the plant.

The literature cited includes a complete bibliography of biological informaton that has been published on *B. gortynoides*. It is hoped that the descriptions of the larva and pupa of *B. gortynoides* might stimulate others to use these additional characters to help clarify the taxonomy of *Bellura* species.

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